

TABLE 1A
Calpine Corp.-RCEC

CO Catalyst Control Costs/Combined Cycle
CAPITAL COST SUMMARY

Full Cost Effectiveness analysis

DIRECT CAPITAL COSTS (2009 \$)		Explanation of Cost Estimates per Turbine/HRSG
1. Purchased Equipment:		Base Cost
A) Pollution Control Equipment	\$800,000	Additional catalyst cost per NE and EPA*
B) Instrumentation & Controls(No CEMS)	\$80,000	EPA1998 10% of Base Cost
C) Freight & Taxes	<u>\$114,400</u>	8% Taxes; 5% Freight; on 1A & 1B
Total Purchased Equip. Costs (TEC):	\$994,400	Sum 1A,1B,1C
2. Installation Costs:		
A) Foundation & Supports	\$0	EPA1998 8% of TEC
B) Erection and Handling	\$139,200	EPA1998 14% of TEC
C) Electrical	\$0	EPA1998 4% of TEC
D) Piping	\$0	EPA1998 2% of TEC
E) Insulation	\$0	1% of TEC
F) Painting	\$0	EPA1998 1% of TEC
G) Site Preparation	<u>\$0</u>	0% of TEC
Total Installation Costs (TINC):	\$139,200	Sum 2A,2B,2C,2D,2E,2F,2G
Total Direct Capital Costs (TDCC):	\$1,133,600	Sum TEC,TINC
INDIRECT CAPITAL COSTS		
1. Engineering & Supervision	\$99,400	EPA1998 10% of TEC
2. Construction and Field Exp.	\$49,700	OAQPS 5% of TEC
3. Contractor Fees	\$99,400	OAQPS 10% of TEC
4. Start-up	\$19,900	OAQPS 2% of TEC
5. Performance Testing	<u>\$9,900</u>	OAQPS 1% of TEC
Total Indirect Capital Costs (TICC):	\$278,300	Sum 1,2,3,4,5,6
Total Direct & Indirect Capital Costs (TDICC):	\$1,411,900	Sum TDCC,TICC
Contingency (@12%):	\$169,400	20% TDICC (std engineering accuracy)
TOTAL CAPITAL COSTS (TCC):	<u>\$1,581,300</u>	Sum TDICC,Contingency

TABLE 1A Cont'd
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ANNUAL OPERATING COST SUMMARY

DIRECT OPERATING COSTS (2003 \$)		Explanation of Cost Estimates
		per Turbine/HRSG
1. Operating Labor	\$45,443	EPA1998 3 hr/day, @41.50 hr
2. Supervisory Labor	\$6,800	OAQPS 15% Operating Labor
3. Maintenance Labor & Materials	\$45,295	2 hr/day, \$41.50/hr, + 100% materials
4. Electricity Expense (\$0.0527/kWh)	\$0	
5. Catalyst Cost (replace)	\$566,100	Scaled from NE data for Currant Creek
6. Fuel Penalty (\$0.0041/scf gas)	\$176,334	.15% fuel increase/inch wc, assumed 1.5" bp
7. Annual Catalyst Cost	\$215,741	CRF, 7%, 3 yrs
Total Direct Operating Costs (TDOC):	\$489,613	Sum 1 through 7
INDIRECT OPERATING COSTS		
1. Overhead	\$27,300	OAQPS 60% Total Labor
Total Indirect Operating Costs (TIOC):	\$27,300	Sum 1
CAPITAL CHARGES COSTS		
1. Property Tax	\$15,800	OAQPS 1% TCC
2. Insurance	\$15,800	OAQPS 1% TCC
3. General Administrative	\$31,600	OAQPS 2% TCC
4. Capital Recovery Cost (7%, 15 years)	\$173,600	10.98%, TCC
Total Capital Charges Costs (TCCC):	\$236,800	Sum 1,2,3,4
TOTAL ANNUALIZED OPERATING COSTS:	\$753,713	Sum TDOC,TIOC,TCCC

TABLE 1A Cont'd

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Controlled Case Emissions		per Turbine/HRSG
Base Uncontrolled Case	10	ppm
Annual Emission Rate	503.4	tpy (50 lbs/hr, 5050 hrs) Includes SU/SD
Incremental Controlled Emissions Case		
CO Concentration	1.5	ppm
Annual Emission Rate:	326	tpy (7.5 lb/hr, 5050 hrs)
CO Reduction from Uncontrolled Case:	177.4	tpy
Control Cost Effectiveness:	\$4,200	per ton CO

References:

OAQPS - OAQPS Cost Control Manual, 5th ED., February 1996.

EPA1998 - Cost Effectiveness fo Oxidation Catalyst Control of HAP Emissions from Stationary Combustion Turbines, EPA, 1998.

* NE estimated cost for additional catalyst to achieve 90% control of CO per EPA study.

* EPA memo dated 12-30-99, Emissions Stds Division, Docket A-95-51, and May 14, 1999 memo on Stationary CT control cost options.